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Iron slag/activated carbon-electrokinetic system with anolyte recycling for single and mixture heavy metals remediation

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Extended Abstract

The electrokinetic process has been proposed for in-situ soil remediation to minimize excavation work and exposure to hazardous materials. The precipitation of heavy metals in alkaline pH near the cathode is still challenging. Reactive filter media and enhancement agents have been used in electrokinetics to enhance the removal of heavy metals. This study investigated coupling industrial iron slag waste and iron slag-activated carbon reactive filter media with electrokinetic for a single and mixture of heavy metals treatment. Instead of using acid enhancement agents, the anolyte solution was recycled to neutralize the alkaline front at the cathode, reducing the operation cost and chemical use. Experiments were conducted for 2 and 3 weeks at 20 mA electric current. Copper removal increased from 3.11% to 23% when iron slag reactive filter media was coupled with electrokinetic. Copper removal increased to 70.14% in the electrokinetic experiment with iron slag-activated carbon reactive filter media. The copper removal increased to 89.21% when the anolyte solution was recycled to the cathode compartment. Copper removal reached 93.45% when the reactive filter media-electrokinetic process with anolyte recirculation was extended to 3 weeks. The reactive filter media- an electrokinetic process with anolyte recycling was evaluated for removing copper, nickel, and zinc mixture, and results revealed 81.1% copper removal, 89.04% nickel removal, and 92.31% zinc removal in a 3-week experiment. The greater nickel and zinc removal is attributed to their higher solubility than copper. The results demonstrated the cost-effectiveness and efficiency of the electrokinetic with iron slag-activated carbon reactive filter media with anolyte recirculation for soil remediation from heavy metals.

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